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a BDSA *export potential study*

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THE MARKET FOR **SEMICONDUCTOR DEVICES** IN WEST GERMANY AND ITALY

U. S. DEPARTMENT OF COMMERCE

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UNITED STATES DEPARTMENT OF COMMERCE

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1964

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FOREWORD

This report is designed to assist U.S. manufacturers of semiconductor devices to sell their products in West Germany and Italy. It is one of a series of export potential studies made by the Business and Defense Services Administration (BDSA), U.S. Department of Commerce. These studies seek to uncover new or expanding opportunities overseas for U.S. businessmen by identifying and describing specific markets for particular products or groups of products.

George Donat, Administrator
Business and Defense Services Administration

April 1964

EDITORIAL PREPARATION

This export potential study was written by Theodore C. Collins, Office of Scientific and Technical Equipment, Business and Defense Services Administration, Donald S. Parris, Director, in collaboration with the Electronics Division of that office.

Commercial Officers of the Foreign Service of the United States collected pertinent information in West Germany and Italy. The Bureau of International Commerce, U.S. Department of Commerce, supplied economic data. Additional sources of information include U.S. Government reports and publications, official government publications of West Germany and Italy, and the Organization for Economic Cooperation and Development.

PREFACE

DESCRIPTION OF SEMICONDUCTOR DEVICES

The semiconductors covered in this study range from the simple to advanced types.

A semiconductor is a material that conducts electricity better than an insulator but not as well as a metal conductor. High-purity germanium and silicon are the semiconductor materials in most common use. The term semiconductor is also used to describe devices made of a semiconductor material. Semiconductors are sometimes called "solid state" devices because their operation depends on the structure and characteristics of solids, whereas conduction in electron tubes occurs in a vacuum or in gas.

Copper oxide and selenium rectifiers, thermistors, and photocells are all semiconductors, although quite different from the newer solid state devices, including transistors, general-purpose diodes and rectifiers, controlled rectifiers, voltage regulators, reference diodes, tunnel diodes, solar cells, light sensitive semiconductor devices, thermoelectric semiconductor junctions, and related semiconductor devices.

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Part I.—Federal Republic of Germany and West Berlin

SUMMARY ANALYSIS

The West German semiconductor market has grown in recent years with the expansion and sophistication of the domestic electronic industries.

West German production of semiconductors[1] increased from DM 85.5 million ($20.4 million) in 1960 to DM110.9 million ($27.7 million) in 1961.[2] It declined to DM92.8 million ($23.2 million) in 1962 as a result of a weakening of domestic and foreign demand, especially for radio and television receivers, concurrent with growing international competition. Production was expected to show a renewed uptrend in 1963.

Semiconductor technology is not as advanced in West Germany as in the United States, owing largely to post-World War II restrictions on the electronic industries and to the relatively small expenditures being made for product research and development. Private industry continues to finance and conduct most research activities in West Germany.

As mass production of the various types of semiconductors becomes possible, West German prices tend to drop to levels equal to or slightly lower than those applicable to similar types imported from the United States.

West German imports of semiconductors reached a peak of DM27.5 million ($6.9 million) in 1961, then fell back to DM25.3 million ($6.3 million) in 1962. In the first half of 1963, they totaled DM15.5 million ($3.9 million). In this 6-month period, the Netherlands, which had been the leading supplier throughout 1960-62, lost its position to the United States.

West German exports of semiconductors rose to DM23.4 million ($5.9 million) in 1962, up 25 percent from the previous year. During the first 6 months of 1963, exports totaled DM10.7 million ($2.7 million).

West German production of and foreign trade in the products in which semiconductors are used continue to present an unsettled picture.

The value of radio and television receiver production in West Germany declined from a peak of DM2,105 million ($501 million) in 1960

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[1] Transistors, diodes, rectifiers, and similar devices.

[2] Value data in this report have been converted from deutschmarks to U.S. dollar equivalents at the rate of 4DM = $1.00, beginning 1961; prior to 1961 at the rate of 4.2 DM = $1.00.

to DM1,828 million ($457 million) in 1962. Product saturation in the domestic market and stiffening international competition were responsible for this trend. From 1960 to 1962 imports of radio and television receivers rose some 134 percent to DM26.9 million while exports dropped 31 percent to DM420.1 million. The United States plays a minor role in this type of trade.

In the radio communications equipment sector, domestic production continued to rise in 1962, reaching almost $100 million. Although total imports increased by more than 50 percent in 1961-62, the U.S. share declined from 20 to 13 percent of the total owing to increased competition and the termination of large government projects.

West German production of electronic measuring, testing, and control equipment and electronic computers has expanded rapidly in recent years. The value of production of electronic computers in 1962 was more than three times the 1960 level; production of electronic measuring, testing, and control equipment increased by more than 42 percent--from DM826 million to DM1,176 million. The United States continued to dominate the import market in 1962, providing 66 percent of West Germany's imported electronic computers and 50 percent of its imported electronic measuring, testing, and control equipment. The demand for labor-saving equipment is attributed to the pressures of rising labor costs and growing competition in domestic and foreign markets.

In general, there is considerable market potential in West Germany for semiconductors imported from the United States. U.S. manufacturers are the sole suppliers of many advanced types of semiconductors; on the other hand, they meet considerable competition in less advanced types.

The market for semiconductors used in electronic measuring, testing, and control equipment, and electronic computers appears to be the most promising as the trend toward increased automation and participation in NATO defense is expected to continue.

Semiconductors imported from the United States are subject to a tariff higher than that for similar imports from the Common Market countries, and also to an equalization tax.

U.S. semiconductor firms can enhance their market position by intensifying their sales, service, and promotional efforts.

THE WEST GERMAN ECONOMY

The West Germany economy has grown at an impressive rate for more than a decade. The country's gross national product (GNP) more than tripled between 1950 and 1962, advancing from $23 billion to $82 billion at current prices. This rate of growth far exceeded the record of the United States in the same period.

Personal consumption expenditures, as a part of GNP, increased from $15 billion in 1950 to $44 billion in 1961. Per capita expenditures rose from $454 in 1954 to $703 in 1961.

The industrial production index of West Germany increased from 203 in 1957 to 263 in 1961 (1950 = 100). The index of manufacturing industries (intermediate producers, capital and consumer goods, and food processing and stimulants) increased from 209 to 275 in the period.

Overall economic growth, however, has been slowing down since 1960. On the basis of constant prices, GNP increased only 4.0 percent in 1962, as compared to 5.5 in 1961 and 8.8 percent in 1960. As a result of considerable losses in output owing to severe winter weather and a reduction in the number of working days, GNP in the first half of 1963 increased only 1 percent over the same period in 1962, again in constant prices. Subsequent production, however, indicates that the growth rate will return to the 1962 level.

Manufacturing industries have actually increased their share of the GNP over the past decade. Personal consumption and government procurement have also grown considerably and are expected to provide ample stimuli for further, but more modest, expansion. This is illustrated, in part, by the 30-percent increase made in defense expenditures in the first half of 1963 over the same period in 1962.

This expansion in West Germany's economy, especially in the industrial and defense sectors, should continue to result in a ready market for semiconductors and the end products in which they are used.

THE SEMICONDUCTOR MARKET

Production

West Germany is the leading producer and exporter of electronic equipment in Europe. The West German electronic industries recorded a healthy growth of about 10-15 percent annually in the past 10 years, and increased threefold between 1954 and 1959. The value of electronic equipment and components produced totaled about $1.3 billion in 1962.

More than 200 companies were engaged in manufacturing electronic products in Germany by 1963. Employment totaled about 165,000, of which 65,000, or almost 40 percent, were in the radio and TV sector.

Emphasis has been shifting in the West German electronic industries from the consumer market toward the market for industrial, commercial, and military items. It is in these nonconsumer sectors that the most encouraging growth is anticipated.

Production of semiconductor devices declined substantially in 1962 owing to steadily declining output of radio receivers attributable primarily to a weakening of domestic and foreign demand concurrent with growing international competition. Production statistics for semiconductors in 1959-62 appear in table 1.

Table 1.— West German Production of Semiconductors, 1959-62

(Thousands of dollars)

Type	1959	1960	1961	1962
Total.....	14,933	20,367	27,731	23,209
Transistors, diodes, and similar devices.....	10,585	14,790	19,877	16,066
Rectifiers.....	4,348	5,577	7,854	7,143

Source: Gesellschaft fur Marktforschung m.b.H.

West German exports of semiconductors reached almost $5.9 million in 1962, an increase of 25 percent over 1961 levels. The Netherlands received 28 percent of West Germany's semiconductor exports in 1962; other important customers were Sweden, Denmark, and Italy, each accounting for about 10 percent of the total.

West German manufacturers who participated in the 1963 Hanover International Industry Fair predicted that quantity production of solid state integrated circuits would begin in the spring of 1964. Companies developing solid state circuitry include Siemens and Halske AG, Telefunken GmbH, and Valvo GmbH. Valvo expected to begin production in 1963 of an integrated circuit consisting of four diodes, one transistor, four resistors, and one capacitor. Telefunken has developed two low-noise UHF mesa tetrodes for use as converters, oscillators, and high-frequency amplifiers.

Research and Development

Electronic components manufacturers so far have not had the benefit of government research funds. The consensus of German components manufacturers at the 1963 Hanover Fair was that they were not likely to undertake development projects without government aid.

The electronic industries have criticized the country's universities for concentrating too heavily on basic research at the expense of applied research. Industry spokesmen reported early in 1963 that by far the greatest proportion of electronics research work being carried out in West Germany was being done in industrial laboratories, and that 80 percent of this work was applied research.

Both industry and universities complain that lack of coordination and communication have led to extensive duplication of effort and misused resources. Shortages of skilled personnel and lack of facilities work a hardship on existing laboratories and their staffs. On the other hand, production technicians claim that laboratories do not turn out enough ideas to keep their production and design staffs busy.

The Domestic Industry

The general interaction of labor supply, wage costs, and productivity in the development of the electronic industries and the semiconductor market has the inevitable effect of increasing the automation of manufacturing, clerical, and service functions.

A persistent shortage of labor makes it necessary to import workers from other countries. In 1962, industrial wage rates in West Germany were, on the average, 35 percent higher than in Italy, 25 percent higher than in Benelux, and 9 percent higher than in France. Of the West German industries, wages per man hour and relevant labor costs in the electronic industries were among the highest; the electronic industry work week, averaging 42.5 hours, was among the shortest in European industry.

Heretofore, there have been no "electronics engineers," their functions being performed by electrical engineers who have specialized in electronics after graduation. Companies are attempting through

a form of apprenticeship to train workers who are not university graduates to become electronics specialist.

Profit margins declined in the electronic industries in 1962 as a result of a 13-percent increase in wage and salary costs combined with only a 1.5-percent increase in productivity.

Distribution

The majority of German semiconductor producers supply their customers direct from the factory or through regional sales offices. Other producers utilize wholesalers and retailers specializing in specific types of end products--radio and television receivers and associated components.

Consumption

Apparent consumption of semiconductor devices in West Germany totaled approximately $23.6 million in 1962--domestic production of $23.2 million plus imports of $6.3 million, minus exports of $5.9 million. This represents a decrease of $6.3 million from the 1961 total of $29.9 million, which stemmed largely from reduced production of television and radio receivers. The reduction in dollar value of consumption is also due in part to a decrease in prices of semiconductors and electronic components from 1961 to 1962. These figures do not allow for those components included in equipment and devices made by large manufacturers who produce their own components.

The consumption of semiconductors, being electronic components, naturally corresponds to the manufacture and sale of electronic end products. In West Germany these end products are in the form of entertainment equipment, radio communications equipment, radar, and other commercial and industrial electronic equipment.

THE MARKET FOR ELECTRONIC PRODUCTS EMPLOYING SEMICONDUCTORS

Entertainment Type Electronic Equipment

The Federal Republic of Germany and West Berlin ranks among the world's leading producers of radio, television, and other electronic equipment for home entertainment. However, the growth of this sector of the West German economy, which was vigorous in the 1955-60 period, has slackened considerably owing to weakening demand in the domestic market and stiffening international competition. Table 2 reflects recent cutbacks in production.

Owners of radio and television receivers must have licenses, which are issued by the German postal authorities. The number of television licenses issued in the Federal Republic passed the 7-million mark in December 1962. More than 90 percent of the 18 million West German households had radio receivers at the end of 1962. Only 1.8 million people owned tape recorders. Approximately 67 percent of West German households have record players. Stereo equipment sales have lagged, but should increase as prices decline and as the trend to larger living quarters continues.

Table 2.— West German Production of Radio and Television Receivers, 1959-62

(Thousands of dollars)

Type	1959	1960	1961	1962
Total	425,510	501,196	492,941	456,971
Radios, total	171,313	181,289	202,555	184,285
Table and console	132,434	125,996	127,638	107,843
Portable	23,072	40,660	52,184	56,354
Automobile	15,807	14,633	22,733	20,088
Television sets, single and combined	254,197	319,907	290,386	272,686

Source: Gesellschaft fur Marktforschung m.b.H.

West Germany's imports of electronic entertainment equipment expanded considerably in 1962 (table 3). Large shipments of table and console radios came from the Netherlands and portable radios from Japan and Sweden.

Table 3.— West German Imports of Radio and Television Receivers, 1960-62

(Thousands of dollars)

Type	1960	1961	1962
Total	2,734	3,784	6,728
Radio receivers, total	2,368	3,168	5,950
Table and console	n.a.	279	1,064
Portable	n.a.	2,339	4,398
Automobile	n.a.	550	488
Television receivers, single and combined	366	616	778

n.a.--Not available.

Source: American Consulate General, Frankfurt; Der Ausson handel der Bundesrepublic Deutschland: Statistisches Bundesant Wiesbaden Teil, 1960.

West German exports of entertainment type electronic equipment decreased from $124 million in 1961 to $105 million in 1962. Major customers were the Netherlands, Switzerland, Sweden, and France.

Radio Communications Equipment and Radar

Production of radar, sonar, and radio communications equipment in West Germany continued to increase in 1962 (table 4).

Table 4.— West German Production of Radio Communications Equipment and Radar, 1959-62

(Thousands of dollars)

Type	1959	1960	1961	1962
Total	53,785	71,079	87,522	99,051
Broadcast transmitters	39,725	55,955	63,765	72,816
Radar, sonar, and similar equipment	4,549	4,741	6,036	9,309
Other radio communications equipment	9,511	10,383	17,721	16,926

Source: Gesellschaft fur Marktforschung m.b.H.

The market situation in the electronic communications equipment field in the Federal Republic is influenced to a great extent by the demand for its products from the Bundespost, the industry's main customer. The outlook for the period through 1966 is optimistic because of plans for increased expenditures by the Bundespost. The amount to be spent in 1962-66 is $2.23 billion, almost double the rate of expenditures in the previous 5 years. Other domestic customers that expect to continue modernization and expansion of their communications facilities include the police, military, public utilities, and railroad and transport operators.

German manufacturers have earmarked large sums for expansion of capacity and modernization in anticipation of increased demand for electronic communications equipment.

The Bundespost operates a microwave network for the transmission of telephone messages and television programs. Expansion and improvement of these services is causing the Bundespost continually to increase the capacity of this system.

In the Federal Republic, VHF omnidirectional radio range (VOR) equipment is being expanded and modernized. Within the framework of the development of a tactical air navigation system for military purposes (TACAN), a range finder that can be used in connection with VOR has been developed. Such VORTAC installations have already been delivered, and are operating successfully.

The German Decca chain is also used for aeronautical radio navigation.

The Federal Ministry of Transport operates 11 radio beacons along the German coast. The Bundespost operates a three-station direction-finding network. In addition, the German Decca chain is available for maritime radio navigation.

Radar is being used in German coastal waters. Telefunken, Decca, and Phillips supply most of this equipment. Most German oceangoing ships are equipped with radar equipment produced by German licensees of foreign manufacturers.

In the production of radar equipment for aviation, Germany has a strong foothold on the world market. Airport surveillance radar (ASR) and precision approach radar (PAR) are being used all over the world.

Because of increased imports from other countries in the European Economic Community (EEC) and Japan, West Germany's total imports of radio communications equipment have risen in recent years (table 5). Meanwhile, imports from the United States have declined as the products from other countries have become more competitive and as large government contracts with U.S. companies have terminated.

Table 5.— West German Imports of Radio Communications Equipment, Total and from the United States, 1960-62

(Thousands of dollars)

Year	Total value	From the United States	
		Value	Percent of total
1960.....	31,167	13,070	42
1961.....	47,679	9,761	20
1962.....	72,938	9,651	13

Source: Der Aussenhandel Der Bundesrepublic Deutschland: Statistisches Bundesant Wiesbaden Teil 1960-62.

Selected Electronic Equipment

The acute labor shortage in the Federal Republic and West Berlin has been an overriding factor in the mounting demand in recent years for electrical measuring, testing, and control equipment and electronic computers (table 6).

Table 6.— West German Production of Selected Electronic Equipment, 1959-62

(Thousands of dollars)

	1959	1960	1961	1962
Total.....	163,845	227,738	311,885	404,587
Measuring equipment....	75,227	92,651	117,497	135,511
Testing equipment.....	13,660	15,692	19,446	21,026
Control equipment.....	66,731	88,276	118,017	137,350
Computers.....	8,227	31,119	56,925	110,700

Source: Gesellschaft fur Marktforschung m.b.H.

German producers of this type of equipment are rapidly closing the technological gap that retarded their progress in the post-World War II years. However, the United States reportedly still is reaping the benefits of advanced technology and lower prices resulting from mass production. The most promising areas for U.S. businessmen are believed to be in electronic controls for the growing aircraft industry, and in controls necessary for the automation of manufacturing processes. Because of the complex nature of these products, prompt and efficient servicing is important in maintaining a firm's position in this market.

About 20 percent of West Germany's total production in 1962 was exported, most of it to European Economic Community countries.

The United States continued to be the largest supplier of automation equipment to West Germany in 1962 (table 7). Japan pulled up faster than other competing countries. However, Japan's share of total imports of this type was still relatively small in 1962--only about 2 percent.

Table 7.--West German Imports of Selected Electronic Equipment, Total and from United States, 1960-62

(Thousands of dollars)

	1960	1961	1962
Electronic measuring, testing, and control equipment:			
Total	16,243	23,590	25,449
From United States	6,545	11,201	12,704
Computers:			
Total	6,821	3,537	6,080
From United States	5,415	1,675	4,013

Source: Der Aussenhandel Der Bundesrepublic Deutschland Statistisches Bundesant Wiesbaden Teil, 1960-62.

THE MARKET FOR U.S.-MANUFACTURED SEMICONDUCTORS

Imports

The United States was the leading supplier of semiconductors to West Germany in the first half of 1963, in terms of value. In the 1960-62 period, the Netherlands was the leading supplier, both in weight and in value of shipments. However, the Netherlands' value share of West German imports declined from 78 percent in 1960 to 46 percent in 1962, while the share of the United States increased from 14 to 27 percent.

Table 8 indicates the changing patterns in West German semiconductor imports.

Table 8.— West German Imports of Semiconductors, by Country of Origin, 1960-62 and January-June 1963

(Thousands of dollars)

Country	1960	1961	1962	January-June 1963
Total	5,930	6,867	6,337	3,868
United States	824	1,441	1,717	1,372
Netherlands	4,605	4,261	2,993	1,351
United Kingdom	n.a.	n.a.	n.a.	303
France	28	65	168	142
Japan	316	328	243	95
Other countries	157	772	1,216	605

n.a.--Not available.

Source: American Consulate General, Frankfurt.

Assessment of Competition

At present, the United States, owing to its technological lead, is the sole supplier of many types of semiconductors to West Germany. However, U.S. semiconductors of the less advanced types meet considerable competition.

The Netherlands has a firm grip on West German imports of simple and inexpensive semiconductors. U.K. and French manufacturers and West German manufacturing subsidiaries of U.S. companies offer the most competition in advanced semiconductors. The subsidiaries sometimes use their sales organizations to distribute other related U.S. component lines, and are themselves large consumers of U.S. semiconductors.

In many cases, U.S. semiconductors are preferred over lower priced non-U.S. products because of their reputation for high quality.

Manufacturers present at the 1963 Hanover Fair expressed the view that West Germany was far behind the United States in miniaturization and microminiaturization.

No detailed comparison of the prices of German and U.S. semiconductors is available. West German industry sources consider their prices equal to or slightly lower than U.S. prices for comparable items.

Prices

Prices of semiconductors are declining with the adoption of mass production techniques. Table 9 compares the price movements of semiconductors and related products in 1961-62.

Table 9.—Index of Prices of Semiconductors and Related Electronic Products in 1961 and 1962

(1958 = 100)

Product	1961	1962
Semiconductors	37	29
Components, including semiconductors	88	84
Entertainment-type electronic products	102	103
Radio communications products	100	103
Control instruments and equipment	104	104
Measuring and testing instruments	109	112

Source: American Consulate General, Frankfurt.

Activity of U.S. Producers in West Germany

The records of the U.S. Trade Center at Frankfurt indicate that there were more than 200 U.S. electronic equipment and components manufacturers active in the German market in mid-1963, selling through agents or sales subsidiaries. A number of these firms also manufacture or assemble components or equipment. Sixty-two of the U.S. firms, including at least 26 manufacturers of components, participated in the Trade Center Electronic Components Show.

To an increasing extent U.S. firms are selling direct to their customers through overseas sales organizations; their use of importers or agents is generally being discontinued.

U.S. firms can usually make deliveries faster than their competitors, according to West German industry sources. Many U.S. firms can supply certain items from stock. Where the maximum delivery time among non-West German, including U.S., firms is 12 weeks, West German manufacturers often require 6 months to 1 year.

Domestic Importers and Distributors

More than 30 of the West German firms engaged in importing and wholesaling electronic components are identified and described in a current U.S. Department of Commerce Trade List.[3] The list can be purchased for $1.00 from the Bureau of International Commerce, U.S. Department of Commerce, Washington, D.C., 20230, or from any Department of Commerce Field Office. The information in the list includes basic trade and industry data; sources of pertinent government regulations; and names, addresses, and functions of more than 60 distributors of electronic products.

When submitting offers to German firms, U.S. exporters should quote prices c.i.f. German or Netherlands port and give details concerning discounts and rebates.

[3]Title: "Electronic Equipment, Electronic Tubes, and other Electronic Components and Accessories—Importers, Dealers, and Manufacturers—Federal Republic of Germany and West Berlin."

West German Trade Promotion

Manufacturers of semiconductors are organized under the Central Association of the German Electrical Industry (ZVEI).

Two trade associations serving the electrical equipment and electronic industries are the Federal Association of Wholesalers of Electrical Equipment and the Central Organization of German Associations of Agents and Brokers.

Some trade publications of the industry are "Elektro-Anzeiger," Elektro-Welt," "Elektronik," "Elektronische Datenverabeitung," "Nachrichten-technische Zeitschrift," "Elektronische Rechenanlagen," and "Elektronische Rundschau."

Exhibitions and fairs play an important role in the development of business relations between manufacturers and dealers and in the exchange of information.

A special exhibition of radio, television, and phonograph equipment is organized every other year and held in a key city, sometimes West Berlin. Equipment is also displayed at the annual spring International Industry Fair in Hanover.

Tariff and Nontariff Barriers

Members of the EEC enjoy the advantage of lower tariff rates on semiconductors than are imposed on competing non-EEC countries. On July 1, 1963, the rate for EEC countries was reduced from 6.0 to 4.8 percent and the rate for other countries was raised from 13.5 to 14.9 percent.

In addition to the tariff, a turnover equalization tax of 6 percent must be paid on all imports.

U.S. Sales Potential in West Germany

Because of their technological headstart and early entry into the West German semiconductor market, U.S. companies are expected to hold their sales lead. However, the markets for certain types of semiconductors are already being exploited by manufacturers in a number of countries. The countries making the strongest inroads are the United Kingdom, France, the Netherlands, and Italy.

The healthy growth in the demand for measuring and testing devices and electronic computers is expected to continue. In this market, U.S. firms have a considerable headstart. Industry's trend toward automation and West Germany's increasing contribution to NATO defense point to a growing demand for advanced semiconductors.

The outlook for the radio communications industry is less promising. The U.S. share of that market has been declining in recent years, as competition from non-U.S. sources intensifies and as large government projects are completed.

The market for semiconductors used in consumer equipment is generally more highly saturated than the market for other types. Further penetration by U.S. firms is most likely in applications where advanced semiconductors can be utilized.

In the opinion of several West German semiconductor users, U.S. firms can enhance their position by:

(1) establishing or expanding sales organizations to enable direct person-to-person contact with potential customers.

(2) improving maintenance and consulting services and other technical support activities.

(3) reducing delivery time, especially on replacement orders.

(4) increasing participation in fairs and exhibitions.

In short, the West German market for American electronic components, including semiconductors, offers U.S. manufacturers excellent opportunities to initiate, develop, and expand their exports to Germany now and in the foreseeable future. The market characteristics, however, are expected to continue to change gradually, the emphasis shifting from consumer and entertainment products to electronic instruments and components for industrial, commercial, and military applications.

The United States will be facing increasingly stiff competition from both domestically produced and imported electronic components, but it should continue to maintain its leading position as an exporter to West Germany. This will be due in no small part to the high reputation which the United States enjoys for advanced design and sophistication of its electronic products and the high standards of reliability and workmanship that these products meet.

Part II.—Italy

SUMMARY ANALYSIS

The demand for semiconductors in Italy is accelerating with the growth and modernization of manufacturing industries. Production in Italy of semiconductors, including transistors, diodes, and similar devices, and rectifiers increased to almost $12 million in 1962.[1] Italy produced about 70 percent of the entertainment type semiconductors it consumed in 1962, and approximately half of its non-entertainment type consumption.

Price competition among manufacturers of entertainment type semiconductors has been so severe that many firms have curtailed or discontinued production of this type. Domestic manufacturers have not undertaken production of advanced types of semiconductors because of the limited demand for most products in that category.

Rising labor costs have placed further pressure on semiconductor manufacturers' profit margins. Thus, the practice of hiring extra employees rather than making more efficient use of the existing work force is giving way to the use of improved methods and labor-saving devices.

Product research and development activity is small by U.S. standards in both the private and the public sectors, but it is growing, especially in the latter. For fiscal year 1963, the Government appropriated $93.5 million for scientific research purposes.

Government contracts and military procurement are also increasing but are likewise small by U.S. standards.

Italy imported almost $4.9 million worth of semiconductors in 1962, up $0.5 million from 1961. The Netherlands maintained its position as leading supplying country by a slim margin over the United States, each of these countries accounting for about 35 percent of Italy's semiconductor imports. In early 1963 the United States took a slight lead over the Netherlands.

Exports from Italy in 1962 exceeded $2.9 million, about 3 times the 1961 total. France, the Netherlands, and West Germany were the major customers.

The outlook for products using semiconductor components is generally favorable. The number of radio receivers in use early in 1963 totaled about 9.2 million. Italian production of transistorized radios is expected to expand, despite growing competition from Japan. The market for table models employing vacuum tubes is declining. Production of transistor radios increased by 70,000 units from 1961 to

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[1] Value data in this report have been converted from lire to U.S. dollar equivalents at the rate of 625 lire = US$1.00.

1962, while production of tube type radios increased by only 37,000 units.

The market for television receivers in Italy is far from saturated. An estimated 3.8 million receivers were in use in early 1963. Production of television receivers was estimated at 850,000 units in 1961 and 790,000 units in 1962; the decline in 1962 was attributable to recurrent strikes during the peak season. Considerable growth is foreseen for transistorized television.

Italy's imports of radio receivers, television receivers, and tape recorders totaled $10.9 million in 1961 and $12.2 million in 1962; exports totaled $8.2 million and $8.8 million in the respective years.

In the field of radio communications and radar equipment, Italian exports greatly exceed imports. In 1962, exports totaled $15.4 million and imports, $4.2 million.

The automation of business and production operations is being encouraged on account of rising labor costs and threats of a labor shortage. Several Italian firms are striving for a share of the growing market for electronic computers and industrial control instruments.

The high-fidelity market is still relatively untapped. FM broadcasting is growing, being encouraged by the Government.

If present trends continue, the United States will displace the Netherlands as Italy's leading source of semiconductors. However, the Netherlands is expected to remain highly competitive, while West Germany, France, and the United Kingdom will probably make substantial gains as contenders for the market.

U.S. manufacturers presently have the advantage of more advanced solid state technology and the ability to produce in volume a wide variety of advanced semiconductors, but Italian and other European manufacturers are closing in. Already, they can produce and sell many entertainment type semiconductors at prices below those of U.S. types. Competition in more advanced semiconductors is expected to intensify in the near future.

In view of the highly competitive and rapidly changing condition in the Italian semiconductor market, close contact is important. A good Italian agent or representative can be an invaluable asset to the U.S. semiconductor exporter.

THE ITALIAN ECONOMY

Italy's gross national product increased substantially in 1954-62, from $20.2 billion to $37.9 billion at current prices. The 1962 increase over 1961 amounted to 12 percent. This increase, however is about double the growth rate in real terms because of inflationary factors. Italy's overall rate of growth in real terms will probably remain between 5 and 6 percent; the 1963 rate was about 5.7 percent.

Italy is rapidly becoming a highly industralized nation, the industrial sector accounting for 40 percent of the total GNP. The most highly industrialized centers are located in northwestern Italian cities including Milan, Turin, and Genoa. Italian industry employs 8 million people, or almost 40 percent of the work force.

In 1962 per capita income in Italy was $700 and steadily rising. Private consumption expenditures continued to advance, reaching $23.9 billion, compared with $21.1 billion in 1961. This rising standard of

living has created an increased demand for consumer goods—automobiles, television sets, refrigerators, and washing machines.

Manufacturing industries increased their share of GNP from 27 percent in 1954 to 33 percent in 1961. This trend reflects the continuing Italian industrialization program, and, as the economy expands, indicates a climate favoring the sale of semiconductors for various manufactured goods.

THE SEMICONDUCTOR MARKET

Production

Semiconductor production in Italy climbed to nearly $12 million in 1962. According to industry estimates, the products made comprised 18 million transistors, diodes, and similar devices, and 800,000 rectifiers. Nearly 67 percent of the total output were of the less advanced varieties used in radio and television receivers (entertainment type semiconductors).

Domestic production accounted for about 70 percent of all entertainment type semiconductors consumed in Italy in 1962 and approximately half of the nonentertainment types.

Italian producers of nonentertainment type semiconductors are faced with the problem of creating a viable market in Italy for many of their newer products, a task not made any easier by the lack of any sizable military consumption. Until a large market develops, domestic manufacturers will not be able to produce a full line at profitable levels.

The picture is quite different in the entertainment type semiconductor market. As a result of severe price competition between the numerous producers of germanium entertainment type semiconductors, several firms had curtailed or discontinued production of this type by June 1963. Industry sources believe more firms may follow suit.

Italy imports most of its technical know-how in the semiconductor field through licensing and affiliation agreements with U.S. and European producers. Only a few firms operating in Italy do any development work, and solid state research is just beginning at the Universities of Bologna and Pavia. Since there is little Government activity in the field, no standards have been developed for Italian military or NATO contracts.

Italian manufacturers are troubled with rising production costs. Semiconductor production in Italy is said to be as fully mechanized as is economically feasible in this field of rapidly changing technology where new developments threaten to render production equipment obsolete long before it is fully depreciated. At the same time, Italy is fast losing the advantage in labor costs it once enjoyed. Overall labor costs in the electronics sector have increased approximately 20 percent since the end of 1961. Wage rates in Italy are equivalent to those in Belgium, France, and the Netherlands.

Italy's semiconductor exports for 1962 are valued at more than $2.9 million, about 3 times the 1961 and 13 times the 1960 level. Major customers were France, which received nearly 34 percent of these exports, and the Netherlands and West Germany, nearly 25 percent each.

Types of Production

Between 60 and 75 percent of Italian production consists of alloy or diffused germanium entertainment type semiconductors of both high and low frequency. Several companies, including Philips Italiana and Societa' Generale Semiconduttori (SGS), make nonplanar silicon transistors and diodes, but only SGS, which is one-third owned by Fairchild Semiconductors of Mountain View, California, makes planar and planar-epitaxial silicon semiconductors.

All Italian producers except Philips Italiana, base their specifications on the 2 N and 1 N systems established by the U.S. Electronic Industries Association for transistors, rectifiers, and diodes.

The manufacturers of low-frequency germanium transistors for use in entertainment products often sell kits of several transistors, designed to the customers' specifications. High-frequency entertainment type germanium transistors are also on the market.

High and low frequency entertainment type silicon transistors were not being marketed in commercial quantities as of late 1962. One company was reported to be selling sample quantities at germanium transistor prices in order to develop the market. It is believed that as Italian demand for semiconductors grows more silicon transistors will be produced, and that soon prices may drop to the level being quoted for low-frequency germanium types.

Advanced types of germanium and silicon semiconductors produced in Italy include silicon planar transistors, silicon planar diodes, silicon rectifiers (non-planar), germanium transistors for computers, and germanium diodes for industrial and computer uses. Philips is the largest producer, and other firms usually follow its lead in prices. The second largest producer is Societa' Generale Semiconduttori.

Research and Development

Research and development activity is being stepped up, aimed at the production of advanced semiconductors and the products in which these components are used.

Government contracts and military procurement, including those from NATO, are small by U.S. standards, but increasing.

In March 1962 it was announced that all research activities were to be coordinated by the Government as part of a national economic program and that scientific research expenditures would increase in proportion to the expected growth in national income. Later in the year a new cabinet post was created for scientific research. Agencies involved in research and development in the electronics field include Consiglio Nazionale delle Ricerche, Instituto Superiore delle Telecommunicazioni, Fondazione Bordoni, and the Institutes of Technology of Milan and Turin.

For the fiscal year ending June 30, 1962, the Italian Government appropriated approximately $92 million for scientific research to be performed by various government ministries and organizations. The appropriation for fiscal year 1963 was $93.5 million. These amounts represent about 0.3 percent of Italy's gross national product, apparently the lowest ratio among the advanced industrial nations of Europe.

Italian space research efforts are presently concentrated on the "San Marco Project," whose goal is the launching in 1964 of a scientific satellite into an equatorial orbit from an Italian mobile platform. Other participation in space programs includes Italy's membership in the European Space Research Organization and the European Launcher Development Organization.

Italian industry spent $83.1 million for research in calendar year 1961, according to preliminary Italian Government estimates. Almost half of this amount went toward a category that includes architecture, engineering, and manufacturing.

Distribution

Italian producers of semiconductors are finding that their rapidly changing and highly competitive market requires that they have highly trained technical personnel to sell their products. For this reason, they prefer to sell direct to industrial customers through their own technical staffs. The high salaries required to attract trained personnel have raised distribution costs to the point where they represent an estimated 20 percent of the selling price. The frequency of small orders adds to distribution cost of locally made products and of imports, which continue to be sold through agents.

Semiconductors from abroad are usually imported direct by electronics manufacturers and assemblers, although some parts and components are distributed by importers to large retailers in the principal cities for sale to radio amateurs and repair shops.

The bulk of Government purchases is made through the Italian Technical Delegation located in the Italian Embassy in Washington, D.C.

Major distribution centers are Milan and Turin. Regional agencies are operated by leading manufacturers, primarily for servicing equipment.

Consumption

Apparent consumption of semiconductor devices in Italy totaled approximately $14 million in 1962, comprising $9.1 million from domestic production and $4.9 million from imports.

Italian consumption of semiconductor devices corresponds to the domestic production of end products using semiconductors as component parts. These products include electronic entertainment type and radio communication equipment, radar, and electronic automation products.

THE MARKET FOR ELECTRONIC PRODUCTS EMPLOYING SEMICONDUCTORS

Entertainment Type Electronic Equipment

The market for vacuum tube radio receivers in Italy is believed to have reached a plateau. Transistor radios, however, are in strong demand, especially the lower priced domestically produced and imported Japanese models. Italian producers hope to promote the sales of the more powerful 7- and 8-transistor radios in which they could compete more effectively. In 1961-62, Italian production of vacuum tube

radio receivers increased by about 5 percent, from an estimated 743,000 sets to 780,000, while production of transistor radio receivers grew twice as fast, from 660,000 to 730,000 sets.

The number of radios in use early in 1963 totaled 9.2 million, according to a Radio Televisione Italiana (RAI) estimate.

The market for television receivers in Italy is far from saturated. The number of sets in use in early 1963 totaled 3.8 million. Transistorized sets are expected to become more popular as they become cheaper and as living standards rise. A challenging potential market for battery powered receivers is represented by the 2 million Italians who live away from the national power grid.

About 790,000 television receivers were produced in Italy in 1962, down from 850,000 in 1961. Both the radio and television industries were affected by a long period of recurrent strikes in the last quarter of 1962. The television industry suffered the greater damage however, because its market is more seasonal and the strikes occurred at the peak selling season.

Italy's overall imports of entertainment type electronic equipment have remained fairly constant in recent years--$12.2 million in 1962 compared with $11.8 million in 1959. Exports, on the other hand, have increased sharply, to $8.8 million in 1962 from $2.4 million in 1959.

Netherlands and West Germany have been the leading suppliers, and Netherlands and France, the leading customers.

The hi-fi market is in its infancy, and FM broadcasting is being developed with the help of the Italian Government.

Radio Communications Equipment and Radar

Increasing production of radio communications and radar equipment in Italy in recent years is due largely to orders from Radio Televisione Italiana (RAI) and foreign buyers. Domestic companies, many of which are affiliated with foreign firms, have orders for air defense systems in Sweden and for fire control equipment with radar and missile tracking gear to be used by NATO forces in West Germany.

Italy's imports of radio communications and radar equipment since 1960 have remained relatively stable. The United Kingdom, the United States, and West Germany continue to be the leading suppliers.

Italy's exports of products of this type totaled $4.3 million in 1960, $17.0 million in 1961, and $15.4 million in 1962. West Germany, France, and the Netherlands were the major customers in this period.

Automation Products

The electronic controls industry in Italy is being encouraged by developments in both the private and the government sectors of the economy. Italian manufacturers are seeking to promote production efficiency by replacing old and outmoded equipment, by investing new capital in plant expansion, and by streamlining working methods. Rising labor costs and prospects of a labor shortage provide further stimuli to demand for the automation of business and production operations. The Italian Defense Ministry is reported to be placing more substantial orders with firms in the electronic controls field. Government participation in space programs such as the San Marco Proj-

ect and membership in EEC space organizations is considered promising by the electronic controls industry.

A leading pharmaceutical company has designed and assembled its own control instrumentation for continuous chemical analysis. Other companies have taken similar action in the petrochemical and electric power fields.

Several Italian firms are striving for a share of the market. In 1961, Italian production of control instruments approximated $3 million. A leading Italian manufacturer of equipment for automation is Cea Perego, which produces special regulators, data logging computers, and process control computers for thermopower stations. This company also makes numerical controls for machines tools. Other companies manufacturing numerical control devices are Compagnie General di Elettricite of Milan, and Prodest of Milan. Olivetti is a leading computer manufacturer. Italian firms are producing in quantity kinetics controls for rolling mills, controls for power generators, and precision instruments.

U.S. firms are the major foreign suppliers of control instruments for the Italian market. European firms, led by West Germany, United Kingdom, and France, provide most of the remaining imports. Total value of imports of electronic control instruments in 1961 amounted to $5 million.

THE MARKET FOR U.S.-MANUFACTURED SEMICONDUCTORS

Imports

Although the Netherlands remained the leading supplier of semiconductors to Italy in 1962, if current trends continue, the United States should take the lead in the near future. The United States held a slightly larger share of the market in early 1963 than the Netherlands, each country accounting for about 35 percent of Italy's imports. West Germany provided approximately 15 percent, and France supplied about 12 percent (table 10).

Table 10.—Italian Imports of Semiconductors, 1960-62[1]

(Thousands of dollars)

Country of origin	1960	1961	1962
Total	3,542	4,398	4,867
Netherlands	1,555	1,539	1,643
United States	1,240	1,409	1,561
West Germany	384	537	734
Other countries	363	913	929

[1]Excluding imports of photocells from the United States, which amounted to $23,000 in 1960.

Source: Statistica Mensile del Commercio con l'Estero Central Institute of Statistics, Rome.

Assessment of Competition

Italian purchases from the United States consist primarily of technically advanced semiconductors not produced in Italy or in other European countries.

European affiliates of U.S. firms will undoubtedly begin producing some of the newer types of semiconductors as European demand for them increases. However, U.S. research in the field and volume production made possible by the large domestic market for advanced semiconductors within the United States have given U.S. exporters of these products a considerable advantage. Italian companies that are affiliated with U.S. firms and have exports to EEC countries as their main purpose include Telettra and Olivetti, Pirelli Applicazione Electroniche, Aziende Techniche Elettroniche Del Sud (ATES), and Fabbrica Italiana Valvole Radio Elettriche (FIVRE).

As of July 1963, at least one German manufacturer, Siemens, was reportedly trying to enter the Italian market with silicon semiconductors of advanced types previously produced only in the United States. Siemens' prices were said to be 30 or 40 percent below those of the equivalent U.S. product, but long delivery times have so far prevented that firm from competing effectively with U.S. manufacturers. Presumably the competition will become more serious in the future, not only from Siemens, but also from the Philips Company in the Netherlands particularly in the area of integrated circuits.

Prices

Meaningful price quotations are almost impossible to obtain in view of the universal practice of giving high discounts to favored and large customers. Industry sources indicated in mid-1963 that discounts of 50 to 80 percent were not uncommon. Societa' Generale Semiconduttori (SGS) reports that its prices for silicon planar transistors and diodes have not changed recently but that there has been a 10-percent decrease for all of its nonplanar silicon and germanium semiconductors. Decreases are also expected by mid-1964 for planar semiconductors. The lowest prices, of course, are found in the highly competitive germanium entertainment type semiconductor field—an extreme example is one producer's price of $1.00 for seven transistors and one diode.

Domestic Importers and Distributors

A trade list giving descriptive data about leading Italian importers and dealers can be purchased for $1.00 from the Bureau of International Commerce, U.S. Department of Commerce, Washington, D.C., 20230, or from any Department of Commerce Field Office. The title of the list is "Electronic Equipment, Electron Tubes, and Other Electronic Components and Accessories—Importers, Dealers, and Manufacturers—Italy."

The highly competitive and rapidly changing semiconductor market in Italy makes it imperative for U.S. exporters to seek aggressive technically capable Italian agents who know the market and who can quickly solve most of the technical problems which are posed by their customers. US. exporters should avoid utilizing agents who already

have numerous accounts requiring their attention and preventing effective promotion of any one product. Both the agent and his U.S. exporter should be thoroughly familiar with Italian customs procedures and the required documentation in order to reduce clearance time to a minimum.

Italian Trade Promotion

The trade association in Italy for all dealers in electrical and electronic equipment, apparatus, accessories, and supplies is:

Confederazione Generale Italiana del Commercio
Piazza G.b. Beli 2,
Roma

The association for Italian agents and representatives is:

Federazione Nazionale Associazioni Agenti
e Rappresentanti di Commercio
Piazza Belgioioso 1,
Milano

"Elettronica," a quarterly technical review devoted to electronics in general, is published at Via Arsenale 21, Torino.

The official trade promotion agency is Instituto Nazionale per il Commercio Estero, or ICE (Italian Institute for Foreign Trade), located at Via Torino 107, Roma. Under the jurisdiction of the Italian Ministry of Foreign Trade, its purpose is to promote good business relations between Italian and foreign companies. It supplies and publishes information on Italian trade and industry and on regulations and laws governing trade with Italy. It also acts as arbiter for the settlement of disputes between Italian and foreign firms, organizes Italian participation in foreign exhibitions and fairs, and helps foreign firms to contact Italian exhibitors.

Tariff and Nontariff Barriers

Under provisions of the European Economic Community, Italian external tariffs on semiconductors were reduced on July 1, 1963, from 27 to 24.4 percent. In comparison, tariffs applicable to Common Market countries were reduced from 16.2 to 14.4 percent. Italian customs officials include transportation costs in assessing the customs fee. They also add a 4-percent equalization charge, a 3.3-percent transaction tax charge, and an 0.5-percent handling charge.

Many of the newer types of semiconductors are not readily classifiable under existing Italian customs specifications. Therefore, special detailed documentation is required and even with such special documentation, customs clearance can consume several days or even weeks of vital delivery time. To avoid this problem, importers frequently pay unofficial "urgency fees" which can add as much as 5 percent to their import costs.

The Italian import license and U.S. export license requirements are also considered important barriers that can add from 1 to 3 months to delivery time. To reduce this delay to a minimum, Italian importers of U.S. semiconductors prefer to hold their orders to under $500 in

value and thus gain exemption from the U.S. export permit required for shipments valued at above this amount.

U.S. Sales Potential in Italy

Demand for semiconductors should continue to increase significantly as Italy's industrial complex develops and advances. No percentage growth figures have been predicted by any source, but because Italy is still less developed in electronic fields than most other Common Market countries, its growth rate in this type of activity may be higher than theirs.

U.S. sales of entertainment type semiconductors such as those already being produced in Italy and the rest of Europe are practically excluded by their higher prices and the tariff barrier they must surmount. U.S. firms seeking to export to Italy should therefore be careful in evaluating the market and the ability of their products to compete both technically and in terms of price and delivery time.

Competition is expected to become stronger in semiconductors, even in the more advanced types, from such countries as the Netherlands, West Germany, United Kingdom, and France. Nevertheless, the outlook for U.S. exports to the Italian semiconductor market appears to be encouraging.

Just as in the past, the more technically advanced semiconductors will continue to offer the U.S. manufacturer his most promising market. This market is being enhanced by steadily increasing sales of Italian radio communication and radar equipment, particularly in the foreign markets. Expanding Italian production in the fields of computers and electronic controls should also provide the U.S. manufacturer of advanced semiconductors a growing market for his products.

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